**Supplementary Material**

**Figure Captions**

**Fig.S1.** Schematic diagram of anaerobic reactor (Note: 1 is anaerobic reactor, 2 is gas collecting bottle, 3 is water collecting bottle, 4 is drain pipe, and 5 is exhaust pipe)

**Fig.S2.** XRD image of magnetic carbon (left) and FeS (right)

**Fig.S3.** Change of TOC during sludge anaerobic digestion with the addition of different materials

**Fig.S4.** Changes of pH during sludge anaerobic digestion with the addition of different materials

**Fig.S5.** Changes of acetic acid (a), propionic acid (b), and butyric acid (c) during sludge anaerobic digestion with the addition different materials

**Fig.S6.** Changes of NH4+-N during sludge anaerobic digestion with the addition of different materials

**Fig. S1**



**Fig. S2**



**Fig. S3**



**Fig. S4**



**Fig. S5**



**Fig. S6**



**List of Tables**

**Tab. S1.** Microbial diversity index of digestion liquid sample in sludge anaerobic digestion systems with the addition of different materials（1, 2, and 3 are the before, middle, and after anaerobic digestion of sludge, respectively）

**Tab. S1.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sample | OTU | Shannon | Simpson | Ace | Chao1 | Coverage |
| C1 | 40186 | 3.940107 | 0.107794 | 1269.430139 | 1273 | 0.993928 |
| C2 | 57383 | 4.399296 | 0.032411 | 1302.886203 | 1285.982249 | 0.995382 |
| C3 | 33560 | 4.256719 | 0.045921 | 1322.579 | 1306.181176 | 0.991256 |
| F1 | 55189 | 2.981031 | 0.172313 | 1202.506816 | 1180.040816 | 0.994727 |
| F2 | 32021 | 4.539756 | 0.032599 | 1295.132849 | 1258.494565 | 0.991068 |
| F3 | 38000 | 4.415854 | 0.041154 | 1341.27118 | 1375.784314 | 0.992342 |
| M1 | 50738 | 4.669017 | 0.031865 | 1467.168915 | 1449.951351 | 0.995567 |
| M2 | 56850 | 3.056017 | 0.201329 | 1167.200784 | 1147.007042 | 0.994422 |
| M3 | 32136 | 4.3283 | 0.043854 | 1276.943678 | 1249.257143 | 0.991131 |